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DEFENDING THE AIRCRAFT CARRIER:
Doctrine and Technology for Survival

by

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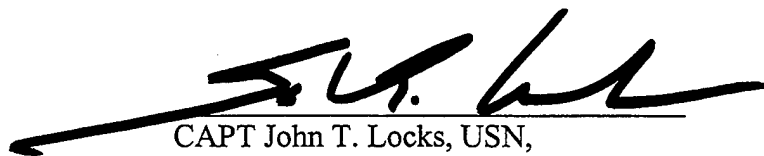
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The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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The Navy today stands at a crossroads. Which direction the Navy takes at this crossroads will determine whether or not the aircraft carrier flourishes within a new doctrine or perishes because of it. The Navy's core combat capabilities, as described in the doctrine statement "Forward...From the Sea: The Navy Operational Concept" are "rooted in the fundamental ability to maneuver independently of political constraints and fight and win" from the littorals.¹ Yet the same policy statement concedes that area denial threats are becoming more and more lethal, threatening the Navy's fundamental ability to project power from the sea. Such enhanced threats were perhaps inevitable as the Navy moved its operations into the littorals. As a result, early post-Cold War uses of sea power in the littorals were tremendously expensive in terms of self-defense. Neither weapons systems nor doctrine was initially ready for the transformation from blue water to littoral operations. Though both have evolved, so has the enemy. This co-evolution affects the aircraft carrier more than any other power projection instrument.

Influencing events ashore is the greatest capability sea power can have. Without this capability, a navy is of limited utility.² As the United States continues to reduce overseas basing and consolidate its military forces within its own borders, the relative value of the aircraft carrier in influencing events abroad will increase, as will its value as a target to potential enemies. Because it is uniquely capable of both influencing the enemy and attracting his attention, the aircraft carrier is and will remain at the center of the vortex. If the Navy intends that the aircraft carrier battle group should play a decisive vice ancillary role in future joint operations, steps must be taken to make the Navy's power projection more credible, while at the same time making it more survivable. Employing technology to increase information-derived power and ship survivability will

give the aircraft carrier greater freedom of action in the littorals. Using sister service capabilities to synergistically improve the air wing's strike nucleus effectiveness will enhance the enormous potential striking power of the aircraft carrier.

The Navy can potentially capitalize on current policy by ensuring the aircraft carrier remains capable of striking the enemy anywhere at any time. Continued infusion of network centric warfare capabilities into new and existing platforms through programs like the Anti-Surface Improvement Program for P-3 aircraft, designing resiliency into the aircraft carrier, and joint cooperative defense all facilitate bringing the full striking power of the aircraft carrier to bear on the enemy, making it a more valuable resource.

History is replete with examples of the destructive effect land and sea based air forces can have on enemy naval surface forces. The Japanese air attack on Pearl Harbor is perhaps the best-known demonstration of the enormous destructive power that air forces can have on surface vessels. Because aircraft excel in operations where the force to space ratio is low, and because it is uniquely able to influence events ashore, the aircraft carrier has dominated U.S. Navy doctrine and operations since Pearl Harbor.³ After Pearl Harbor, it was the Battle of Midway that firmly tied air and surface operations together. Moreover, this epochal battle pointed the way to success in future joint operations. Since the Battle of Midway, the use of air power has been synonymous with maritime operations. During World War II, aircraft were responsible for sinking more warships than any other units.⁴ More recently, aircraft were responsible for destroying or damaging 22 of the 24 surface vessels so affected during the Falklands conflict.⁵ As the offensive capabilities of aircraft expand, the challenge for aircraft carrier proponents is to protect the ship while remaining capable of projecting power.

Defense of sea-based war fighting components while conducting joint littoral operations, which is presumed to be the doctrinal way of the future, must be done more effectively. Emerging doctrine must find a way to tap the aircraft carrier's potential offensive capability. U.S. Navy performance during the Gulf War served as a wake-up call in many respects.⁶ Six aircraft carriers participated in Operation Desert Storm. Due to the potential air threat and restricted maneuvering room, three of these carriers were positioned in the Red Sea. Iraqi aircraft could not reach these aircraft carriers without being refueled over Saudi Arabia, a capability that Iraq did not possess. Although both distance and an effective air defense zone existed between Iraq and these carriers, they flew 28 percent of their sorties for air defense. This war contradicted Cold War Navy doctrine. Fighting the Soviet Navy at sea would probably have necessitated that number of air defense sorties. But because of this defensive posture, carrier-based aircraft, which comprised 23 percent of coalition resources, flew only 17 percent of the attack sorties.⁷ In contrast, Marine Corps aircraft, operating ashore, flew more attack sorties than did Navy aircraft, with half as many aircraft.⁸ Because most Gulf War carrier aircraft were built for defense, no carrier strike sorties were able to designate their own precision munitions and none were capable of deep strike missions. Cold War doctrine saddled the Navy with tactics and hardware that were oriented for war at sea, not deep strike.

New doctrine must be crafted if the aircraft carrier battle group is to be a significant contributor to future joint operations. Steps must be taken to make the Navy's power projection capability more credible while at the same time making the Navy more survivable. The task is a daunting one. Recognizing the doctrinal disaster of Desert Storm, the Navy boldly changed course and declared in "From the Sea" and subsequent

documents that the Navy will operate in the littoral environment in order to influence future events.⁹ The object of this doctrinal shift was to maximize the Navy's ability to bring the striking power of the aircraft carrier to bear on the enemy while at the same time minimizing the cost of self-defense.

Therein lies the conundrum with which the aircraft carrier battle group is faced. In order to render our maritime forces more effective at influencing events ashore, they must now operate in the littorals. In the littorals, however, the potential threat to maritime forces is the greatest. While operating in the littorals is a traditional mission of the U.S. Navy, several recent generations of sailors conducted few littoral operations. While U.S. attention was directed elsewhere, technology aided the enemy in the littorals. The potential threat from modern aircraft, missile systems, mines, and submarines has increased dramatically. Warships have encountered each of these threats with misfortune in recent years. The operational commander must find a way to deal with these threats in time of conflict while bringing the offensive power of the aircraft carrier to bear on the enemy.

Whether the aircraft carrier becomes a critical strength or critical weakness of U.S. military power is pertinent because both proponent and opponent of the aircraft carrier recognize that it is an extremely lucrative target. There exists no more convincing symbol of U.S. political will or American military might than the presence of a big deck aircraft carrier. But projecting this power comes at a potential price. In the cost-benefit calculus associated with utilizing an aircraft carrier, one must carefully consider the risk associated with its loss. In working this equation, Navy commanders have erred to the conservative side in recent conflicts. The Gulf War calculus is discussed above. Other

examples exist. During the eleven days of offensive operations that comprised Operation Deliberate Force in Bosnia, 58 carrier-based strike aircraft were able to produce an attack sortie rate of 0.9 per aircraft per day. By contrast, 46 Air Force aircraft were able to produce a sortie rate of 1.5 per aircraft per day.¹⁰ The difference in the two results from potential additional carrier strike sorties being devoted to self-defense. Apparently, offensive employment of the aircraft carrier had yet to be maximized, even three years after "From the Sea" was promulgated. Opponents of the aircraft carrier have used the term "self-licking ice cream cone" to describe what it has become. As potentially the greatest source of power projection in the U.S. arsenal, particularly in the littorals, the value of the aircraft carrier is so great that its primary mission has become to defend itself. Critics contend that it exists merely to continue to exist.

In this context, an old Air Force argument of the 1950s resurfaces. That argument asserts that for the aircraft carrier to merely exist is not enough. The function of the aircraft carrier is a primary mission of the Air Force. While sea-based air power can be projected without diplomatic permission, it does so at considerable cost in aircraft performance. Critics contend that aircraft carriers are expensive to build and maintain, and very difficult to defend.¹¹ Much of the evidence presented above seems to broadly support this argument.

There is, however, a way out. If the aircraft carrier is to be a potent power projection instrument of the future, its striking power must significantly outweigh the cost of defending it. Joint doctrine reminds one that synchronized action by air, land, and sea forces increases the effectiveness of the joint force.¹² That increase in total effectiveness is achieved by synergistic employment of forces. During Operation Allied

Force, the JTF Commander successfully defended USS THEODORE ROOSEVELT using assets entirely non-organic to the aircraft carrier battle group. Employing P-3 aircraft and both U.S. and Allied submarines for surface and subsurface defense, while employing Air Force F-15C and allied interceptors for air defense made this possible. The inherent mobility of the aircraft carrier was also used in its own defense. As a result of these actions, the entire carrier air wing could devote its efforts to strike operations in Kosovo. Such creative use of assets seems to be in keeping with General Charles Krulak's recommendation to creatively manipulate forces in order to achieve that synergistic effect inherent to joint operations.¹³

Network Centric Warfare (NCW) is one concept that promises to dramatically enhance existing defense capabilities. The essential tenet of NCW involves providing increasing amounts of information to the war fighter, converting this information into knowledge, and from this knowledge deriving combat power.¹⁴ The concept may be as simple as using systems to better locate enemy ships and submarines and to disseminate this information to permit the aircraft carrier to either maneuver or use deception in avoidance. In a more offensive scenario, knowledge of enemy locations may permit employment of standoff weapons to destroy potential adversaries before they become a threat at sea. Existing paradigms requiring that certain ordnance be delivered from certain platforms are being made obsolete.¹⁵ As a result, disparate platforms employing multiple types of munitions in concert for both offensive and defensive operations must become the norm. This is but one limited concept of how harnessing the power of NCW should revolutionize littoral warfare. Since enemy states will undoubtedly attempt to harness the power associated with NCW, it is incumbent upon the operational

commander to treat seriously the emerging capability of informational warfare.

Information has always been important to the commander; what currently distinguishes battlespace knowledge from the way it was historically used is its quantity and, more importantly, information's transformation into actionable knowledge. This transformation of the way we use information will profoundly impact the way we fight.¹⁶

Examples of how NCW has dramatically altered the conduct of littoral warfare already exist. During recent air attacks on Kosovo, employment of P-3 aircraft demonstrated the dramatic increase in combat power available to a force that is given the ability to observe, assimilate, and impact battlespace events.¹⁷ This NCW capability was introduced to the P-3 aircraft by way of the Anti-Surface Warfare Improvement Program (AIP). The AIP program dramatically improves the P-3's sensor, communications, and armament capabilities.¹⁸ With this modification, the P-3 has evolved from a blue water subsurface surveillance and attack platform to one fully compatible with the tenets of NCW and "Forward...From the Sea: The Navy Operational Concept". With a modest investment in the integration of existing technologies, the P-3 transformation, which occurred virtually overnight, generated a dramatic improvement in combat effectiveness. This effectiveness was demonstrated as these aircraft performed their mission on station in the Adriatic Sea in defense of the aircraft carrier battle group. All of the information available to the P-3, to include real-time electro-optic and synthetic aperture radar video, was available to afloat sea combat commanders. Because a single source of combat power was able to perform around the clock surveillance, intelligence gathering, armed surface combat air patrol, and undersea warfare guard, the entire aircraft carrier air wing was left to perform the strike mission, unencumbered by the need to simultaneously

defend itself. Use of the P-3 aircraft in this manner demonstrated the dramatic increase in combat power available through NCW. Contrast this with the Gulf War method of aircraft employment in which 28 percent of air wing sorties were devoted to aircraft carrier defense, and therefore not available for power projection.

Evolution of doctrine has permitted incorporation of non-organic aircraft to project power for the aircraft carrier as well as defend it, further enhancing the aircraft carrier's effectiveness. In addition to the way in which land-based P-3 aircraft were able to defend the aircraft carrier, P-3s were also able to strike for the aircraft carrier. AIP gave P-3s a precision strike capability using the Standoff Land Attack Missile (SLAM). Coupled with high endurance, high search rate, standoff identification and targeting, and robust information-link capability, the P-3 was able to effectively employ the SLAM against mobile targets in Yugoslavia when other weapons platforms could not.¹⁹ Employment of patrol aircraft in the strike role reflected a doctrinal epiphany; successful application of information technology requires a major shift in investment, doctrine, and training.²⁰ The shift from a platform-centric system of weapons employment to a capability-based system in which the power of the network is harnessed can yield a dramatic increase in destructive power. AIP P-3 aircraft operating in the precision strike role embody the revolution in military affairs achievable through information superiority.

There were many senior commanders, however, who eschewed using patrol aircraft for precision strike. Operational commanders must be aware of and must accommodate those advances that increase combat power. Doctrine must evolve based on new capacities. If this does not occur, the revolution in war fighting associated with NCW cannot be fully implemented. And if NCW is not fully implemented, instruments

of power such as the aircraft carrier will not properly evolve, at least doctrinally, and are doomed to obsolescence. The example of the successful P-3 revolution is one that should be emulated with other platforms.

Beyond the rapid advances technology offers in information warfare, technological developments should also be applicable to other areas of military art and science. Specifically, technology should be able to aid in the construction of more survivable combat vessels. Noted British military thinker Basil Liddell Hart observed, "The large ground organization of a modern air force is its Achilles' heel."²¹ This reflection is appropriate in discussing defense of the aircraft carrier. Liddell Hart tells us that bringing the offensive advantages of air power to bear on the enemy has a price. This price is the vulnerable support element associated with that air power. Though Liddell Hart was commenting on land-based air forces, his observation becomes particularly appropriate when discussing sea-based air power. In this context, it is the aircraft carrier that is the Achilles' heel of the carrier air wing. The aircraft carrier does not exist to defend itself; it exists to operate strike aircraft. In fact, those aircraft are the only offensive weapon an aircraft carrier possesses. When this is considered, it becomes apparent why defending the aircraft carrier is so important.

Just as jet engine technology transformed World War II aircraft into the powerful machines of today, so the aircraft carrier should be able to evolve with construction advances currently available. The aircraft carrier should become more capable of self-defense than is currently the case. For example, an aircraft carrier's only current defense against air threats is a close-in weapons system. A more robust capability in this area, particularly if designed from the ground up with NCW in mind, could be very effective.

Another area in which technology could aid in defense is the area of "resiliency".

Though superior damage control is undoubtedly a hallmark U.S. Navy capability, more should be done in terms of the ability to resist and recover from damage. Certainly experience in recent years with mines and air-to-surface missiles provides adequate example that warships are vulnerable when attacked. Improving an aircraft carrier's resiliency involves designing in a more rapid repair or even a self-repair capability. Also involved may be the design of more redundant systems which are able to function despite minor combat damage.²² Improving the survivability of a ship entails making it less susceptible to attack and less vulnerable when attacked. Current aircraft carriers are austere in terms of vulnerability; they have little redundancy and resiliency. This is perhaps one reason why commanders are forced to compensate by making them less susceptible to attack through protection by large numbers of defensive aircraft sorties. New technologies in shipbuilding and NCW exist which will allow new aircraft carriers to strike a better balance between vulnerability and susceptibility.²³ Advances in technology like improved armor, enhanced underwater protection to include superior flooding control and less fragile propulsion elements, and better defensive weapons systems can make the aircraft carrier less vulnerable. Network centric warfare has much to offer in the area of susceptibility. Ideally, improvements will be designed into the CVX and future aircraft carriers. Better survivability will permit more effective employment of the aircraft carrier, with the overall goal of improving the capacity to project power in the littorals. Designing aircraft carriers that are more survivable will involve a modest cost increase. This cost is one that must be paid if the U.S. Navy intends to employ aircraft carriers in the littorals.²⁴

Operating jointly can also improve the efficiency of defending the aircraft carrier in a littoral environment. History provides an example. Faced with the reality that insufficient assets existed to counter the World War II Axis submarine threat to Allied shipping, the Chief of Naval Operations requested assistance from the Army Air Corps. Eventually, Army Air Corps aircraft assumed the majority of antisubmarine patrol off the U.S. East Coast, though its personnel and aircraft were neither initially trained to perform nor built for that mission.²⁵ Perhaps this synergy of effort can again be harnessed. Today's operational commander has great potential to enhance war fighting effectiveness if able to marry multiservice capabilities with innovative modern technology.

Significant benefits may be derived from exploiting the defensive capabilities of other services. One recent example of joint involvement should serve as a model for future operations. During Operation Allied Force in Kosovo, Air Force F-15C and allied interceptor aircraft provided the entire contingent of combat air patrol serving to protect against enemy aircraft attempting to destroy air, land, and naval forces. Such an arrangement was conducted in the true spirit of joint and coalition warfare in that it sought to build on the unique capabilities of each component force. For example, the F-15C is a superb air superiority fighter, and the F-14 and F/A-18 are very capable precision strike aircraft. By utilizing the F-15C in the combat air patrol role, and using Navy aircraft to perform overland attack, the strong suit of each aircraft was emphasized, and a synergistic effect was realized. Such joint operations show how it may be possible to recapture the spirit of teamwork displayed during World War II.

The commander can realize an increase in combat effectiveness by properly structuring a joint task force and its subordinate commands. While unity of command is

imperative for successful operations, creatively manipulating command structure will yield more warfighting capability.²⁶ The concept of joint combined strength is not new. Navies have assisted armies for centuries with supporting fires, logistics, and maneuver. But it is possible for other services to support the Navy, as well. Enlisting joint support for defense of the aircraft carrier battle group is a prime example of how to increase combat power. Utilizing the formidable air wing team of 50 attack aircraft capable of delivering precision guided munitions and five electronic attack aircraft offers greater offensive proficiency than using a team divided to perform both offensive and defensive tasks. If precision air strikes are a primary focus of the campaign, or possibly the only focus of the campaign, then using the carrier air wing exclusively for that purpose while utilizing other assets in defense of the aircraft carrier is a logical action. The logic that component or even service commands should support the lead combat element of a campaign is therefore not remarkable.

In fact, an Air Force-Navy joint memorandum of agreement was signed in 1982 for just that purpose.²⁷ In this agreement, the Air Force was to assume an increasingly maritime role, both in the offensive and defensive role. The agreement, while popular for a period of time, faded into virtual obscurity. This occurred for a number of reasons. Lack of interest on the part of the Air Force in assuming a Navy-oriented mission and fear on the part of the Navy that the Air Force would begin to covet that mission were prominent among them. The Air Force should be considered a resource for defense of the aircraft carrier because it has dedicated interceptors and the associated support mechanism that would allow Navy precision strike aircraft to be used exclusively for projecting power. Using Air Force assets to defend the aircraft carrier would be

particularly appropriate if Air Force aircraft enhance the success of maritime strike operations.²⁸ The goal is joint operations providing increased combat effectiveness.

If operating jointly should be pursued because it makes for more effective war fighting, then training is the key to implementation.²⁹ During Operation Desert Storm, Army M1A1 and Marine M60A1 tanks had the same kill ratio versus Iraqi armor. Because the M1A1 is far superior to the M60A1, the conclusion drawn is that training is at least as essential as technology in war fighting.³⁰ As related to the aircraft carrier, redistribution of certain missions has already mandated training to enable interoperability. Refueling and electronic attack led the way. The Navy and Air Force relinquished carrier-based aerial refueling and electronic attack capability, respectively, some time ago. Although some initial difficulty was encountered in relying on another service's assets, these complications were soon amended.³¹ Training and joint exercises were the key to what is now an assumed capability. In fact, no carrier strike operation since 1990 has been undertaken without land based refueling support.³² As forces operate more jointly, the land/sea interface will become more seamless; and the aircraft carrier has the potential to become more valuable in such operations. Training is the means of ensuring the aircraft carrier thrives in this environment.

If such a shift in the focus of joint operations were to take place in order to support aircraft carrier strike operations, it may be necessary to rethink the concept of the carrier air wing. Though varied, the current configuration is nominally one F-14 squadron (14 aircraft), three F/A-18 squadrons (36 aircraft), one EA-6B squadron (5 aircraft), one E-2 squadron (4 aircraft), one S-3 squadron (8 aircraft), and one SH/HH-60 squadron (6 aircraft). If aircraft carrier defense can be improved through the increase in

combat power associated with network centric warfare, use of AIP P-3 aircraft, designed-in resiliency, and synergy of joint operations, then perhaps optimizing the air wing mix is possible. Such a shift may even be prudent in terms of maintaining combat applicability. The goal is to increase the firepower of the air wing by adding more precision strike aircraft. Clearly this would mean more F/A-18C, and later F/A-18E/F or Joint Strike Fighters, as they are acquired. If it is necessary to replace existing aircraft in order to maintain a zero-sum gain, then several alternatives exist. For example if only four of the current eight S-3s could adequately perform recovery tanker duty then perhaps four could be replaced by F/A-18s in the air wing. This is but one example, meant to stimulate the thought that perhaps more combat power can be achieved within the existing air wing structure. Certainly not a single airframe should be removed from the air wing unless a replacement is procured and in place, assuming that aircraft retains a valid mission.

This argument could take on added significance. If the trend of the United States military to consolidate within its borders continues, it is conceivable that in certain circumstances, the aircraft carrier may be the only strike option available. One can credibly imagine a scenario in which nations that neighbor a targeted country offer only conditional basing and overflight rights, permitting support but not strike aircraft access to their sovereign territory. If this sounds plausible, the case could be made that all tactical aircraft and aircrew, regardless of service, must be capable of operating from the aircraft carrier. Making joint use of the aircraft carrier's flight deck would serve to dramatically improve the flexibility of combat operations. Evidence exists that this is a direction in which the U.S. military ought to be moving. Since the Air Force retired its EF-111 aircraft, the sole electronic attack aircraft in the U.S. inventory is the EA-6B.

Both aircraft and crew, now joint, are capable of carrier operations. As budget realities drive joint procurement of aircraft, such as the Joint Strike Fighter, more airframes will be designed and built to be capable of carrier operations. The keys to implementing a truly joint aircraft carrier are training and doctrine. Such changes may actually be necessary to ensure survival of the aircraft carrier.

There are blind proponents of the aircraft carrier who claim that no change in defense doctrine is necessary to ensure survival of the species. They are willing to accept the status quo of defending the aircraft carrier solely with organic assets. However, the aircraft carrier will not be capable of providing enough punch in future joint operations if it must be defended with organic assets. There are also those who would argue that our reliance on network centric warfare is dangerous because it will produce spiritless war fighters and doctrine that precludes us from getting our hands dirty.³³ They would argue that the Navy's new standoff force and weapons are not in keeping with the very nature of littoral warfare envisioned in "From the Sea". But to accept that our expensive, high technology ships cannot be used more effectively in a high threat littoral environment is ignoring reality. The aircraft carrier can and will be used in the littorals in a hostile environment; it is therefore incumbent on commanders to maximize the effectiveness with which it is used. While it is true that the aircraft carrier may, at times, need to operate completely autonomously, this will likely be the exception rather than the rule. If the aircraft carrier must fight autonomously, a relatively large portion of sorties devoted to protecting the aircraft carrier is understood to be the cost associated with striking alone. New doctrine should acknowledge the possibility that the aircraft carrier may have to fight alone, but emerging doctrine should provide ways of increasing its punch when

the aircraft carrier operates jointly the vast majority of the time. Freedom of action in the littorals can be obtained through exploiting new technologies in network centric warfare and ship survivability. The vast striking potential of the air wing can be better tapped through synergistic use of multi service capabilities.

The aircraft carrier has much to offer as an instrument of power projection. Autonomous operations without regard to basing or overflight rights and elements of security and deception were all reasons for selection of the aircraft carrier as the sole source of attack aircraft to accomplish strike objectives during Operation Desert Fox, in which Navy Tomahawk missiles were also used. If the aircraft carrier is to remain a viable and potent strike weapon for the future, then improvements in its defense capability must be made. Combat efficiency must be enhanced through continued funding of AIP P-3 aircraft and other network centric platforms. Combat effectiveness must be increased through improvement in aircraft carrier survivability and a shift of doctrine to permit more joint defense. The viability and applicability of the aircraft carrier can be made greater by modifications of air wing composition and training all military aircraft and aircrew to operate from the carrier. Taking the correct turn at the crossroads will ensure survival of the aircraft carrier.

¹ Jay L. Johnson, forward by, *Forward...From the Sea: The Navy Operational Concept*, (Washington DC: Department of the Navy, March 1997), 2.

² Milan N. Vego, *Naval Strategy and Operations in Narrow Seas* (London: Frank Cass Publishers, 1999), 295.

³ Andrew G. B. Vallance, *The Air Weapon: Doctrines of Air Power Strategy and Operational Art* (London: Macmillan Press Ltd., 1996), 92.

⁴ Ibid., 86-87.

⁵ Ibid., 87.

⁶ Rebecca Grant, "The Carrier Myth," *Air Force Magazine*, March 1999, 2-3.

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- ⁷ Vallance, 107.
- ⁸ Grant, 3.
- ⁹ Department of the Navy, *From the Sea: Preparing the Naval Service for the 21st Century*, (Washington, DC, September 1992), 10.
- ¹⁰ Grant, 5.
- ¹¹ Bradley, 52.
- ¹² Joint Chiefs of Staff, *Doctrine for Joint Operations* (Joint Pub 3-0) (Washington, DC: 1 February 1995), II-4.
- ¹³ Charles C. Krulak, "Doctrine for Joint Force Integration," *Joint Force Quarterly*, Winter 1996/97, 23.
- ¹⁴ David S. Alberts, John J. Garstka, and Frederick P. Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority*, 2nd ed. (DoD C4ISR Cooperative Research Program, 1999), 115.
- ¹⁵ Johnson, 10.
- ¹⁶ Alberts, 79.
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- ¹⁸ Jeffery G. Freeman, "Orion Hunts Again," *U.S. Naval Institute Proceedings*, November 1999, 60.
- ¹⁹ *Ibid.*, 61.
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- ²¹ Vallance, 152.
- ²² *Ibid.*, 160.
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- ²⁶ Krulak, 23.
- ²⁷ Bradley, 54-55.
- ²⁸ W. E. Simons, *Potential Air Force Contributions to Sea Control in Limited War: A Contextual Analysis* (Santa Monica, CA: U.S. Air Force Project Rand, 1976), 4-5.
- ²⁹ Simons, 68-69.
- ³⁰ Mackubin T. Owens, "The Use and Abuse of 'Jointness'," *Marine Corps Gazette*, November 1997, 56.
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- ³² Grant, 7.
- ³³ Arthur, Richard C., "Patrol Craft Can Maintain Littoral Sea Control," *U.S. Naval Institute Proceedings*, August 1999, 70.

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